PATENT APPLICATION

PATENT AND TRADEMARK OFFICE

BEFORE THE HONORABLE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of

Shuichi ICHIKAWA et al.

On Appeal from Group: 2859

Application No.: 10/505,334

Examiner: G. VERBITSKY

Filed: August 23, 2004

Docket No.: 120868

For: METHOD OF MEASURING THERMAL CONDUCTIVITY OF HONEYCOMB STRUCTURE

APPEAL BRIEF TRANSMITTAL

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Attached hereto is our Brief on Appeal in the above-identified application.

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Respectfully submitted,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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For: METHOD OF MEASURING THERMAL CONDUCTIVITY OF HONEYCOMB STRUCTURE

BRIEF ON APPEAL

Appeal from Group 2855

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I. REAL PARTY IN INTEREST

The real party in interest NGK Insulators, Ltd., by way of an Assignment recorded in the U.S. Patent and Trademark Office at Reel 016236, Frame 0420.

II. RELATED APPEALS AND INTERFERENCES

There are no prior or pending appeals, interferences or judicial proceedings, known to Appellants, Appellants' representative, or the Assignee, that may be related to, or that will directly affect or be directly affected by, or have a bearing upon, the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 13, 16-18, 22, 24 and 25 stand rejected and are on appeal.

Claims 13, 16-18, 22, 24 and 25 are pending.

No claims are allowed.

IV. STATUS OF AMENDMENTS

An Amendment After Final Rejection was filed on August 21, 2007 that amended independent claim 18. None of the other pending claims were amended.

In a September 12, 2007 Advisory Action, Examiner Verbitsky indicated that the August 21, 2007 Amendment After Final Rejection would not be entered because amended claim 18 did not overcome the 35 U.S.C. §103(a) rejection over the combination of U.S. Patent No. 5,846,276 to Nagai et al. in view of U.S. Patent No. 6,331,075 to Amer.

In an October 3, 2007 Supplemental Advisory Action, Examiner Verbitsky indicated that the August 21, 2007 Amendment After Final Rejection overcomes the 35 U.S.C. §103(a) rejection over the combination of U.S. Patent No. 5,693,685 to Kishimoto et al. in view of U.S. Patent No. 6,331,075 to Amer et al., but would not be entered because the newly added limitation required a new search.

A Pre-Appeal Brief Request for Review was filed on October 4, 2007. A Notice of Panel Decision from Pre-Appeal Brief Review was mailed by the U.S. Patent and Trademark Office on November 6, 2007 indicating that the application remains under appeal.

Because the August 21, 2007 Amendment After Final Rejection was not entered, the claims on appeal are in the form as amended in the Amendment filed on January 10, 2007.

This Appeal proceeds with respect to claims 13, 16-18, 22, 24 and 25.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The subject matter recited in independent claim 18 is directed to a method for measurement of thermal conductivity of a honeycomb structure 1 (see Fig. 2). It is necessary to determine the thermal conductivity of a honeycomb structure, such as, for instance, a honeycomb structure through which a high-temperature gas passes (page 2, lines 6-11). This method is distinguished from the prior art processes that require preparation of a test specimen (page 2, lines 6-15 and 22-25). Specifically, an object of the subject matter of the pending claim is to provide a method for measurement of thermal conductivity of a honeycomb structure which can measure the thermal conductivity of a honeycomb structure in the shape of a honeycomb structure *per se* or in a predetermined block shape without preparing a test specimen of a particular shape (page 2, line 27 - page 3, line 2).

Independent claim 18 recites a method for measurement of thermal conductivity of a honeycomb structure 1 (see Fig. 2), comprising: contacting two ends (see Figs. 1 and 2, Elements 11 and 12) of the honeycomb structure with contact members (see Figs. 1 and 2, Elements 21 and 22); covering exposed sides (see Fig. 2, Element 13) of the honeycomb structure with heat-insulating material (see Fig. 2, Element 5); keeping the whole honeycomb structure 1 in a steady temperature state with keeping two ends 21 and 22 of the honeycomb structure 1 at given different temperatures (see page 4, lines 4-6, Elements T1 and T2); and measuring a thermal conductivity of the honeycomb structure 1 in a steady state. Independent claim 18 also recites that the contact members 21 and 22 are kept at different temperatures T1 and T2 and are contacted with the two ends 11 and 12 of the honeycomb structure 1 to keep the two ends 11 and 12 of the honeycomb structure 1 at given different temperatures T1 and T2; the two ends 11 and 12 of the honeycomb structure 1 and the contact members 21 and 22 are contacted with each other via high-thermal conductivity members (see Fig. 2, Elements 41 and 42); and each high-thermal conductivity member 42 is made of a film formed by applying

a paste (see page 11, lines 4-14) containing a substance of high-thermal conductivity, on a contact face 11 and 12 of the honeycomb structure 1 and/or a contact face (see Fig. 1, Elements 211 and 222) of a contact member 21 and 22.

The subject matter of the pending claims, therefore, positively recites, among other features, that two ends of a honeycomb structure are contacted with contact members via high-thermal conductivity members, exposed sides of a honeycomb structure are covered with heat-insulating material, and the high-thermal conductivity member is made of a film formed by applying a paste containing a substance of high-thermal conductivity on a contact face of the honeycomb structure and/or the contact member. These details are described in Applicants' specification at least in the paragraphs beginning on page 2, line 6, page 11, line 4 and page 12, line 5.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The following grounds of rejection are presented for review on Appeal:

1) Claims 13, 16-18, 22 and 24 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,693,685 to Kishimoto et al. (hereinafter "Kishimoto") in view of U.S. Patent No. 6,331,075 B1 to Amer et al. (hereinafter "Amer").

2) Claim 25 is rejected under 35 U.S.C. §103(a) as being unpatentable over Kishimoto in view of Amer and further in view of U.S. Patent No. 6,730,421 to Kirino et al. (hereinafter "Kirino").

VII. ARGUMENT

A. CLAIM 18 IS NOT OBVIOUS IN VIEW OF THE PRIOR ART

The Examiner rejects claim 18 under 35 U.S.C. §103(a) as being unpatentable over Kishimoto in view of Amer. Patent Office procedures provide "[f]actual findings made by Office personnel are the necessary underpinnings to establish obviousness" (MPEP §2141(II.)). With respect to all of the claims that are pending and rejected in this application, the Examiner has failed to clearly articulate a rationale, based upon the facts, to support an obviousness rejection, and thus has improperly applied the law relating to obviousness. Proper application of the law demonstrates that a *prima facie* case for obviousness has not been shown, and that the claimed subject matter would not have been obvious over any permissible combination of the applied prior art references.

1. No Permissible Combination of Amer and Kishimoto Would Result in the Combination of Features Positively Recited in Pending Claim 18

The subject matter of claim 18 is directed to a method of measurement of thermal conductivity of a honeycomb structure which can measure the thermal conductivity of the structure in its actual shape without requiring preparing a test specimen or the like. The method recited in the claims addresses a long-standing need to have a capability for accurately determining the thermal conductivity of a honeycomb structure without damaging or altering the structure. No permissible combination of Amer and Kishimoto would result in a combination having several of the features positively recited in claim 18, including: (1) measuring a thermal conductivity of a honeycomb structure, (2) covering exposed sides of a honeycomb structure with heat-insulating material, and (3) keeping a whole honeycomb structure in a steady temperature state.

With respect to the first of the above three claim features, the Office Action renders interpretations of what would have been suggested by the combination of applied references

that are substantively unreasonable for the reasons described below. With respect to the second and third of the above three claim features, the Office Action fails to clearly articulate any rationale based on objective evidence that these features would reasonably have been suggested by the combination of applied references.

a. No Reasonable Interpretation That Can Be Afforded To the Combination of Amer and Kishimoto Results in A Method of Measuring a Thermal Conductivity of a Honeycomb Structure

Amer discloses a method of measuring the conductivity of thin films, such as paint, having a thickness of between 50 and 150 μm (see, *e.g.*, Amer, col. 2 lines 25-29). Kishimoto discloses a thermal insulator made of foamed plastic containing a solidified carbon dioxide gas and a method for producing the thermal insulator (see, e.g., Kishimoto, col. 5, lines 8-12). Neither Amer nor Kishimoto can reasonably be interpreted as disclosing a honeycomb structure, or a method of testing the thermal conductivity of a honeycomb structure, as recited in claim 18. The basis proffered by the Examiner in support of the conclusion that the combination of Amer and Kishomoto discloses a honeycomb structure is substantively erroneous.

With respect to Amer, the Office Action, on page 5, states that a non-homogeneous stack of thin films, in a broad sense, could be considered as a honeycomb structure. With respect to Kishimoto, the Office Action, on page 5, references Fig. 1 of Kishimoto, asserts that a closed cell foamed plastic could, in a broad sense, be considered a "porous film," and that "any porous structure, in a broadest reasonable interpretation, could be considered a honeycomb structure (emphasis in original)." Appellants respectfully submit that these interpretations are substantively in error for the following reasons.

Amer cannot reasonably be considered to teach a honeycomb structure because the totality of the Amer disclosure is limited to testing "thin solid films" having a thickness of

less than .15 mm. Kishimoto cannot reasonably be considered to teach a honeycomb structure because the totality of the Kishimoto disclosure is limited to closed cell foamed plastic 2 and metal carbonate 3 in a closed container 1. Conversely, Appellants' specification, on page 13, provides an example of a honeycomb structure having a height of 25 mm. Appellants' specification also describes, on page 1, honeycomb structures as having a large number of through-holes surrounded by partition walls extending in an axial direction, the honeycomb structures being formed to enable the capture and removal of particulate matter contained in a dust-containing fluid. Extending the disclosures of either or both of Amer and Kishimoto to cover the claimed structures is (1) unreasonable, (2) unsupportable based on the positive disclosures in the references, and (3) strains any broadest reasonable construction of either the subject matter of the pending claims or the teachings of the applied references.

For the totality of the above reasons, the combination of Amer and Kishimoto cannot be considered to teach a honeycomb structure, even in a broad sense. Any assertion to the contrary applies an unreasonably broad interpretation of what the combination of these references could have suggested. The rejection of claim 18 should be withdrawn.

b. The Office Action Fails to Articulate Any Reasoning For Determining that the Combination of Amer and Kishimoto Would Have Suggested Covering Exposed Sides of a Honeycomb Structure with Heat-Insulating Material

The Office Action provides a conclusory statement, on page 2, that Amer teaches the method of measurement of thermal conductivity of a honeycomb structure recited in claim 18. However, the Office Action fails to articulate any reasoning with regard to the specific suggestion of the feature covering exposed sides of a honeycomb structure with heat-insulating material. The Office Action, in fact, does not even direct Appellants to where this feature is alleged to have been suggested in the applied references.

Appellants have reviewed the applied references, and the combination of Amer and Kishimoto fails to even have suggested this feature. The Office Action admits that Kishimoto does not teach a method for determining thermal conductivity. Amer fails to overcome this deficiency of Kishimoto. Amer discloses a method of measuring the thermal conductivity of thin film samples. The thermal conductivity measurements of these thin film samples are performed in a bell-jar maintained at very low pressure to protect the thin film from ambient conditions, especially to protect against radiant heat losses (*see, e.g.,* Amer, col. 4, lines 29-38).

In contrast to Amer, Appellants' specification teaches a method of measurement of thermal conductivity of honeycomb structures that are considerably larger than the thin films disclosed in Amer. The method recited in claim 18 includes covering exposed sides with heat-insulating material. The rejection of claim 18 should be withdrawn because the Office Action fails to articulate any actual articulated reasoning, supported by, for example, any rational underpinning that this feature would have been suggested by the combination of applied references. Appellants purport that no such reasoning can be articulated because neither Amer nor Kishimoto, even in a broad sense, would have suggested this feature.

c. The Office Action Fails to Articulate Any Reasoning For Determining that the Combination of Amer and Kishimoto Would Have Suggested Measuring the Thermal Conductivity of a Whole Honeycomb Structure

Claim 18 recites a method of measurement of thermal conductivity of a whole honeycomb structure. The Office Action fails to articulate any reasoning for a determination that the combination of applied references would have suggested measuring the thermal conductivity of a whole honeycomb structure. The Office Action thus fails to meet the relevant standards for establishing that a method of measurement of thermal conductivity

having all of the features positively recited in claim 18 would have been obvious over the combination of applied references.

Appellants have reviewed the applied references, and the combination of Amer and Kishimoto fails to teach or to have suggested this feature. As previously noted, the Office Action admits that Kishimoto does not teach a method for determining thermal conductivity. For the following reasons, Amer fails to overcome the deficiencies of Kishimoto. The Amer method, which is directed to measurement of thermal conductivity of thin films, would require damaging a honeycomb structure to prepare a specimen having a thickness of 50-150 μm. This action alone is contrary to the objectives addressed by the claimed subject matter. Amer thus fails to have suggested a method of measuring the thermal conductivity of a whole honeycomb structure. The rejection of claim 18 should be withdrawn because the Office Action cannot articulate any reasoning for a determination that this feature would have been suggested by the combination of Amer and Kishimoto.

2. Amer and Kishimoto Are Not Combinable in the Manner Suggested

A "key to supporting any rejection under 35 U.S.C. §103(a) is the clear articulation of the reason(s) why the claimed invention would have been obvious" (MPEP §2143). In *KSR International Co. v. Teleflex Inc.*, 550 U.S. ___, ___, 82 USPQ2d 1385 (2007) (hereinafter *KSR*), the Supreme Court noted that the analysis supporting a rejection under 35 U.S.C. §103(a) should be made explicit (MPEP §2143). With respect to all of the claims that are pending and rejected in this application, the Examiner has failed to comply with the applicable procedures in meeting the relevant standard. The conclusory statement, on page 2 of the Office Action, that "it would have been obvious to apply a method taught by Amer, to measure a thermal conductivity of a structure of Kishimoto" fails in this regard. The Examiner does not clearly articulate the reasons, supported by any objective evidence, why

the asserted combination would have been obvious. Appellants provide the following reasons why Amer and Kishimoto are, in fact, not combinable in the manner suggested.

Amer discloses a method of measuring the conductivity of thin solid films, such as paint. The method taught in Amer is limited to use with thin films, as demonstrated by the totality of the Amer disclosure, and is well less sweeping than the Office Action alleges. For example, Amer expressly indicates that it teaches a method of measuring thermal conductivity of thin films having a thickness of between 50 and 150 μm (see, *e.g.*, col. 2 lines 25-29). Several of the features of the Amer device and method evidence that the method is limited for use with thin films. For instance, Amer requires the use of conductive slabs in which six small, high resolution thermocouples are embedded to accurately measure the small temperature differences (col. 3, lines 13-15 and col. 5, lines 17-20). This feature is required because samples measured by the Amer device are highly sensitive to ambient conditions due to the small thin film thickness. Additionally, as described above, in Amer the thin film samples are placed, and the thermal conductivity measurements are performed, in a bell-jar maintained at very low pressure to protect against radiant heat losses (col. 4, lines 29-38). Amer teaches that the tested specimen can be applied directly to one of the conductive slabs (see col. 3, lines 61-64) and the only specific example given for such a directly applied specimen is thin films such as paint.

In view of these features, there would have been no motivation to use this method to test the thermal conductivity of a specimen that is not a thin solid film. There is no suggestion that the method of Amer is even capable of measuring the thermal conductivity of larger bodies, *i.e.*, honeycomb structures, to any extent, including to an extent that would satisfy the requirements of a §103 obviousness analysis.

Further, Kishimoto fails to disclose a thin film having a thickness of less than 150 μm that is capable of being tested by the method of Amer. The Kishimoto structure shown in Fig.

1 is a closed cell foamed plastic in a rigid container. Testing the Kishimoto structures using the Amer method would require damaging the Kishimoto structure to prepare a specimen having a thickness of 50-150 μm. There is no suggestion in Amer or Kishimoto that such a thin film specimen can be obtained from the Kishimoto structure. Further, the combining Amer and Kishimoto in the manner suggested, even if possible, would not provide a method of measuring the thermal conductivity of a whole honeycomb structure without the necessity of preparing a test specimen, which is contrary to the purpose of the recited method. The Examiner fails to clearly provide any indicia of objective evidence in the prior art that reasonably would have supported any manner of predictability to making the asserted combination with any reasonable expectation of success.

In fact, modifying Amer in the manner inarticulately suggested by the Office Action with the teachings of Amer would likely require such modification of the Amer method to be impermissible. At a minimum, such modification would impermissibly alter the principle of operation of the Amer device.

For at least the reasons set forth above, and the fact that the Office Action lacks some objective reasoning with some rational underpinning as is required even after the Supreme Court's decision in *KSR*, it is not clear from the Office Action that one of ordinary skill in the art would have been motivated to combine the references. It is, however, clear from the totality of the evidence that it is unlikely that the combination of the applied references would have led to any predictable result, much less the result achieved by the pending claims.

3. The Office Action Appears to Fail to Apply a Proper Standard for Combining the References in the Manner Suggested

In the footnote at the bottom of page 5, the Office Action notes there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is what that the combination of disclosures taken as a whole would

suggest to one of ordinary skill in the art (*In re McLaughlin*, 170 USPQ 209 (CCPA 1971)). This standard does not absolve the Examiner from providing some reasonable combination and objective evidence of some reason for combining the references in the manner suggested (see *In re Kahn*, 441 F.3d 977 (Fed. Cir. 2006) favorably endorsed by the U.S. Supreme Court in *KSR*).

Also, to any extent that the 1969 CCPA decision in *In re Bozek* is relied upon to fill a void in the analysis, the Federal Circuit has clearly explained that *In re Bozek* does not relieve the Examiner from the requirement to provide evidence to support the conclusion of obviousness. In 2002, the Federal Circuit specifically addressed the BPAI's erroneous application of the precedent of *Bozek* in *In re Lee*, 277 F.3d 1338. The Federal Circuit specifically stated that *Bozek* did not hold that objective analysis, proper authority, and reasonable findings can be omitted from Board decisions. The determination of patentability must be based on evidence. *Id.* at 1345.

B. CLAIMS 13, 16, 17, 22 AND 24 ARE NOT OBVIOUS IN VIEW OF THE PRIOR ART

The Examiner rejects claims 13, 16, 17, 22 and 24 under 35 U.S.C. §103(a) as being unpatentable over Kishimoto in view of Amer. Appellants submit that the subject matter of claims 13, 16, 17, 22 and 24 also would not have been suggested by the combination of Kishimoto and Amer for at least the respective dependence of these claims, directly or indirectly, on allowable base claim 1, as well as for the separately patentable subject matter that each of these claims recites.

C. CLAIM 25 IS NOT OBVIOUS IN VIEW OF THE APPLIED PRIOR ART

The Examiner rejects claim 25 under 35 U.S.C. §103(a) as being unpatentable over Kishimoto in view of Amer and further in view of Kirino. All of the arguments presented above in support of the patentability of claims 13, 16-18, 22 and 24 apply equally to the

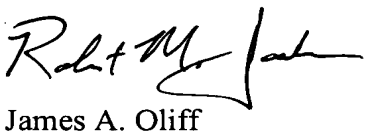
patentability of claim 25 because Kirino does not overcome the shortfalls enumerated above in the combinations of the other applied references to the subject matter of at least independent claim 1.

VIII. CONCLUSION

Appellants respectfully submit that the rejections of the enumerated claims are improper in view of MPEP §§2143.01-.02 and Federal Circuit precedent because the rejections lack the requisite evidence that the features would have been obvious to one of ordinary skill in the art, and that one of ordinary skill in the art would have had a reasonable expectation of success making the asserted combination of references.

For all of the reasons discussed above, Appellants respectfully submit that the rejections are in error and that claims 13, 16-18, 22, 24 and 25 are in condition for allowance. Accordingly, Appellants respectfully request this Honorable Board to reverse the rejections of claims 13, 16-18, 22, 24 and 25.

Respectfully submitted,



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APPENDIX A - CLAIMS APPENDIX

CLAIMS INVOLVED IN THE APPEAL:

13. The method for measurement of thermal conductivity of a honeycomb structure according to Claim 18, wherein the thermal conductivity λ (W/mK) of the honeycomb structure is calculated from the following expression (1):

$$\lambda = QH \cdot [L/(T1 - T2)] \quad (1)$$

where the thermal conductivity λ (W/mK) of the honeycomb structure is specified in relation to:

an amount of heat flow QH (W/m2) = [(Q1 + Q2)/2], each of Q1 (W/m2) and Q2 (W/m2) being obtained by measuring an amount of heat flow at each contact member using a heat flow meter connected with the contact member;

a distance L (m) between the two ends of the honeycomb structure; and

temperatures T1 (K) and T2 (K) of the two ends of the honeycomb structure in the steady temperature state of the whole honeycomb structure.

16. The method for measurement of thermal conductivity of a honeycomb structure according to Claim 18, wherein a sheet having flexibility is used as the high-thermal-conductivity member.

17. The method for measurement of thermal conductivity of a honeycomb structure according to Claim 13, wherein a sheet having flexibility is used as the high-thermal-conductivity member.

18. A method for measurement of thermal conductivity of a honeycomb structure, the method comprising the steps of:

contacting two ends of the honeycomb structure with contact members;

covering exposed sides of the honeycomb structure with heat-insulating material;

keeping the whole honeycomb structure in a steady temperature state with keeping two ends of the honeycomb structure at given different temperatures; and

measuring a thermal conductivity of the honeycomb structure in the steady state, wherein:

the contact members are kept at given different temperatures and are contacted with the two ends of the honeycomb structure to keep the two ends of the honeycomb structure at given different temperatures;

the two ends of the honeycomb structure and the contact members are contacted with each other via high-thermal-conductivity members; and

each high-thermal-conductivity member is made of a film formed by applying a paste containing a substance of high-thermal conductivity, on a contact face of the honeycomb structure and/or the contact member.

22. The method for measurement of thermal conductivity of a honeycomb structure according to Claim 18, wherein a contact pressure between the contact member and the end of the honeycomb structure is set at 1 to 10 kg/cm2.

24. The method for measurement of thermal conductivity of a honeycomb structure according to Claim 18, wherein the honeycomb structure is made of a material having a thermal conductivity of 1 (W/mK) or more.

25. The method for measurement of thermal conductivity of a honeycomb structure according to Claim 18, wherein the honeycomb structure contains at least one kind selected from the group consisting of silicon carbide, a composite of silicon carbide and metallic silicon, and silicon nitride.

APPENDIX B - EVIDENCE APPENDIX

NONE

APPENDIX C - RELATED PROCEEDINGS APPENDIX

NONE